QUICK REVIEW 2.1 *(For help, go to Sections A.2. and P.4)*

In Exercises 1–2, write an equation in slope-intercept form for a line with the given slope m and y-intercept b.

1. $m = 8, \quad b = 3.6$ **2.** $m = -1.8, \quad b = -2$

In Exercises 3–4, write an equation for the line containing the given points. Graph the line and points.

3. $(-2, 4)$ and $(3, 1)$ **4.** $(1, 5)$ and $(-2, -3)$

In Exercises 5–8, expand the expression.

5. $(x + 3)^2$ **6.** $(x - 4)^2$

7. $3(x - 6)^2$ **8.** $-3(x + 7)^2$

In Exercises 9–10, factor the trinomial.

9. $2x^2 - 4x + 2$ **10.** $3x^2 + 12x + 12$

SECTION 2.1 EXERCISES

In Exercises 1–6, determine which are polynomial functions. For those that are, state the degree and leading coefficient. For those that are not, explain why not.

1. $f(x) = 3x^{-5} + 17$ **2.** $f(x) = -9 + 2x$

3. $f(x) = 2x^5 - \frac{1}{2}x + 9$ **4.** $f(x) = 13$

5. $h(x) = \sqrt[3]{27x^3 + 8x^6}$ **6.** $k(x) = 4x - 5x^2$

In Exercises 7–12, write an equation for the linear function f satisfying the given conditions. Graph $y = f(x)$.

7. $f(-5) = -1$ and $f(2) = 4$

8. $f(-3) = 5$ and $f(6) = -2$

9. $f(-4) = 6$ and $f(-1) = 2$

10. $f(1) = 2$ and $f(5) = 7$

11. $f(0) = 3$ and $f(3) = 0$

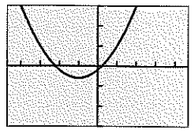
12. $f(-4) = 0$ and $f(0) = 2$

In Exercises 13–18, match a graph to the function. Explain your choice.

13. $f(x) = 2(x + 1)^2 - 3$ **14.** $f(x) = 3(x + 2)^2 - 7$

15. $f(x) = 4 - 3(x - 1)^2$ **16.** $f(x) = 12 - 2(x - 1)^2$

17. $f(x) = 2(x - 1)^2 - 3$ **18.** $f(x) = 12 - 2(x + 1)^2$



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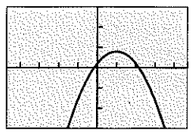

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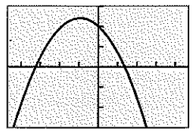

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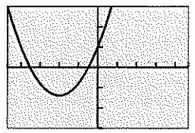

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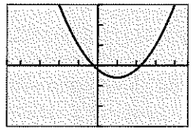

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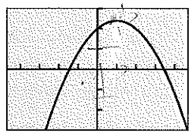


(f)

In Exercises 19–22, describe how to transform the graph of $f(x) = x^2$ into the graph of the given function. Sketch each graph by hand.

19. $g(x) = (x - 3)^2 - 2$ **20.** $h(x) = \frac{1}{4}x^2 - 1$

21. $g(x) = \frac{1}{2}(x + 2)^2 - 3$ **22.** $h(x) = -3x^2 + 2$

In Exercises 23–26, find the vertex and axis of the graph of the function.

23. $f(x) = 3(x - 1)^2 + 5$ **24.** $g(x) = -3(x + 2)^2 - 1$

25. $f(x) = 5(x - 1)^2 - 7$ **26.** $g(x) = 2(x - \sqrt{3})^2 + 4$

In Exercises 27–32, find the vertex and axis of the graph of the function. Rewrite the equation for the function in vertex form.

27. $f(x) = 3x^2 + 5x - 4$ **28.** $f(x) = -2x^2 + 7x - 3$

29. $f(x) = 8x - x^2 + 3$ **30.** $f(x) = 6 - 2x + 4x^2$

31. $g(x) = 5x^2 + 4 - 6x$ **32.** $h(x) = -2x^2 - 7x - 4$

In Exercises 33–38, use completing the square to describe the graph of each function. Support your answers graphically.

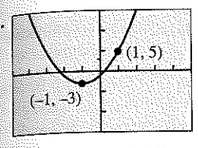
33. $f(x) = x^2 - 4x + 6$ **34.** $g(x) = x^2 - 6x + 12$

35. $f(x) = 10 - 16x - x^2$ **36.** $h(x) = 8 + 2x - x^2$

37. $f(x) = 2x^2 + 6x + 7$ **38.** $g(x) = 5x^2 - 25x + 12$

In Exercises 39–42, write an equation for the parabola shown, using the fact that one of the given points is the vertex.

39.



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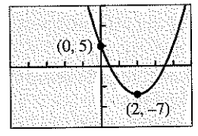

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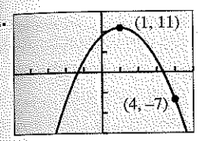

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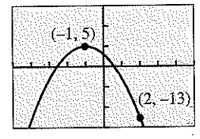

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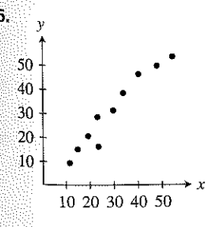
In Exercises 43 and 44, write an equation for the quadratic function whose graph contains the given vertex and point.

43. Vertex $(1, 3)$, point $(0, 5)$

44. Vertex $(-2, -5)$, point $(-4, -27)$

In Exercises 45–48, describe the strength and direction of the linear correlation.

45.



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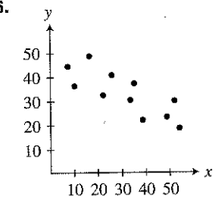

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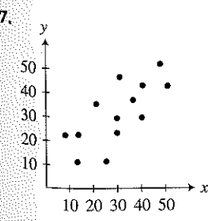

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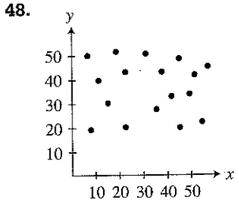


49. Comparing Age and Weight A group of male children were weighed. Their ages and weights are recorded in Table 2.4.

Table 2.4 Children's Age and Weight

Age (months)	Weight (pounds)
18	23
20	25
24	24
26	32
27	33
29	29
34	35
39	39
42	44

(a) Draw a scatter plot of these data.

(b) Writing to Learn Describe the strength and direction of the correlation between age and weight.

50. Life Expectancy Table 2.5 shows the average number of additional years a U.S. citizen is expected to live for various ages.

Table 2.5 U.S. Life Expectancy

Age (years)	Life Expectancy (years)
10	67.4
20	57.7
30	48.2
40	38.8
50	29.8
60	21.5
70	14.3
80	8.6

Source: U.S. National Center for Health Statistics, Vital Statistics of the United States.

(a) Draw a scatter plot of these data.

(b) Writing to Learn Describe the strength and direction of the correlation between age and life expectancy.

51. Straight-Line Depreciation Mai Lee bought a computer for her home office and depreciated it over 5 years using the straight-line method. If its initial value was \$2350, what is its value 3 years later?

52. Costly Doll Making Patrick's doll-making business has weekly fixed costs of \$350. If the cost for materials is \$4.70 per doll and his total weekly costs average \$500, about how many dolls does Patrick make each week?

53. Table 2.6 shows the average hourly compensation of production workers in manufacturing for several years. Let x be the number of years since 1970, so that $x = 5$ stands for 1975, and so forth.

Table 2.6 Production Worker Average

Year	Hourly Compensation (dollars)
1975	6.36
1985	13.01
1995	17.19
2002	21.37

Source: U.S. Bureau of Labor Statistics as reported in The World Almanac and Book of Facts, 2005.

(a) Writing to Learn Find the linear regression model for the data. What does the slope in the regression model represent?

(b) Use the linear regression model to predict the production worker average hourly compensation in the year 2010.

54. Finding Maximum Area Among all the rectangles whose perimeters are 100 ft, find the dimensions of the one with maximum area.

55. Determining Revenue The per unit price p (in dollars) of a popular toy when x units (in thousands) are produced is modeled by the function

$$\text{price} = p = 12 - 0.025x.$$

The revenue (in thousands of dollars) is the product of the price per unit and the number of units (in thousands) produced. That is,

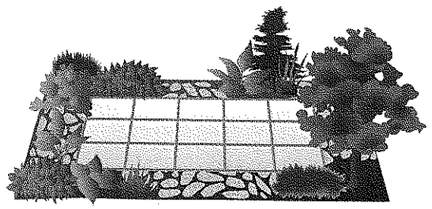
$$\text{revenue} = xp = x(12 - 0.025x).$$

(a) State the dimensions of a viewing window that shows a graph of the revenue model for producing 0 to 100,000 units.

(b) How many units should be produced if the total revenue is to be $1,000,000?

56. Finding the Dimensions of a Painting A large painting in the style of Rubens is 3 ft longer than it is wide. If the wooden frame is 12 in. wide, the area of the picture and frame is 208 ft^2, find the dimensions of the painting.

57. Using Algebra in Landscape Design Julie Stone designed a rectangular patio that is 25 ft by 40 ft. This patio is surrounded by a terraced strip of uniform width planted with small trees and shrubs. If the area A of this terraced strip is 504 ft^2, find the width x of the strip.



58. Management Planning The Welcome Home apartment rental company has 1600 units available, of which 800 are currently rented at $300 per month. A market survey indicates that each $5 decrease in monthly rent will result in 20 new leases.

(a) Determine a function $R(x)$ that models the total rental income realized by Welcome Home, where x is the number of $5 decreases in monthly rent.

(b) Find a graph of $R(x)$ for rent levels between $175 and $300 (that is, $0 \le x \le 25$) that clearly shows a maximum for $R(x)$.

(c) What rent will yield Welcome Home the maximum monthly income?

59. Group Activity Beverage Business The Sweet Drip Beverage Co. sells cans of soda pop in machines. It finds that sales average 26,000 cans per month when the cans sell for 50¢ each. For each nickel increase in the price, the sales per month drop by 1000 cans.

(a) Determine a function $R(x)$ that models the total revenue realized by Sweet Drip, where x is the number of $0.05 increases in the price of a can.

(b) Find a graph of $R(x)$ that clearly shows a maximum for $R(x)$.

(c) How much should Sweet Drip charge per can to realize the maximum revenue? What is the maximum revenue?

60. Group Activity Sales Manager Planning Jack was named District Manager of the Month at the Sylvania Wire Co. due to his hiring study. It shows that each of the 30 salespersons he supervises average $50,000 in sales each month, and that for each additional salesperson he would hire, the average sales would decrease $1000 per month. Jack concluded his study by suggesting a number of salespersons that he should hire to maximize sales. What was that number?

61. Free-Fall Motion As a promotion for the Houston Astros downtown ballpark, a competition is held to see who can throw a baseball the highest from the front row of the upper deck of seats, 83 ft above field level. The winner throws the ball with an initial vertical velocity of 92 ft/sec and it lands on the infield grass.

(a) Find the maximum height of the base ball.

(b) How much time is the ball in the air?

(c) Determine its vertical velocity when it hits the ground.

62. Baseball Throwing Machine The Sandusky Little League uses a baseball throwing machine to help train 10-year-old players to catch high pop-ups. It throws the baseball straight up with an initial velocity of 48 ft/sec from a height of 3.5 ft.

(a) Find an equation that models the height of the ball t seconds after it is thrown.

(b) What is the maximum height the baseball will reach? How many seconds will it take to reach that height?

63. Fireworks Planning At the Bakersville Fourth of July celebration, fireworks are shot by remote control into the air from a pit that is 10 ft below the earth's surface.

(a) Find an equation that models the height of an aerial bomb t seconds after it is shot upwards with an initial velocity of 80 ft/sec. Graph the equation.

(b) What is the maximum height above ground level that the aerial bomb will reach? How many seconds will it take to reach that height?

64. Landscape Engineering In her first project after being employed by Land Scapes International, Becky designs a decorative water fountain that will shoot water to a maximum height of 48 ft. What should be the initial velocity of each drop of water to achieve this maximum height? (*Hint*: Use a grapher and a guess-and-check strategy.)

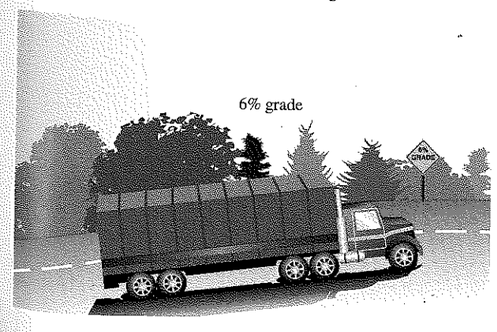
65. Patent Applications Using quadratic regression on the data in Table 2.7, predict the year when the number of patent application will reach 450,000. Let $x = 0$ stand for 1980, $x = 10$ for 1990 and so forth.

Table 2.7 U.S. Patent Applications

Year	Applications (thousands)
1980	113.0
1990	176.7
1995	228.8
1998	261.4
1999	289.5
2000	315.8
2001	346.6
2002	357.5
2003	367.0

Source: U.S. Census Bureau, Statistical Abstract of the United States, 2004–2005 (124th ed., Washington, D.C., 2004).

66. Highway Engineering Interstate 70 west of Denver, Colorado, has a section posted as a 6% grade. This means that for a horizontal change of 100 ft there is a 6-ft vertical change.



(a) Find the slope of this section of the highway.

(b) On a highway with a 6% grade what is the horizontal distance required to climb 250 ft?

(c) A sign along the highway says 6% grade for the next 7 mi. Estimate how many feet of vertical change there are along those 7 mi. (There are 5280 ft in 1 mile.)

67. A group of female children were weighed. Their ages and weights are recorded in Table 2.8.

Table 2.8 Children's Ages and Weights

Age (months)	Weight (pounds)
19	22
21	23
24	25
27	28
29	31
31	28
34	32
38	34
43	39

(a) Draw a scatter plot of the data.

(b) Find the linear regression model.

(c) Interpret the slope of the linear regression equation.

(d) Superimpose the regression line on the scatter plot.

(e) Use the regression model to predict the weight of a 30-month-old girl.

68. Table 2.9 shows the median U.S. family income (in 2003 dollars) for selected years. Let x be the number of years since 1940.

Table 2.9 Median Family Income in the U.S. (in 2003 dollars)

Year	Median Family Income ($)
1947	21,201
1973	43,219
1979	45,989
1989	49,014
1995	48,679
2000	54,191
2003	52,680

Source: Economic Policy Institute, *The State of Working America 2004/2005* (ILR Press, 2005).

(a) Find the linear regression model for the data.

(b) Use it to predict the median U.S. family income in 2010.